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Ellis

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(54) **TUBULAR LOCK LATCH ASSEMBLY**

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(73) Assignee: **Newfrey, LLC**, Newark, DE (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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Related U.S. Application Data

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(51) **Int. Cl.**
E05B 9/00 (2006.01)

(52) **U.S. Cl.** **292/337**; 292/1.5

(58) **Field of Classification Search** 292/337, 292/165, 169, 1.5, 336.3; 70/472, 244, 208, 70/210
See application file for complete search history.

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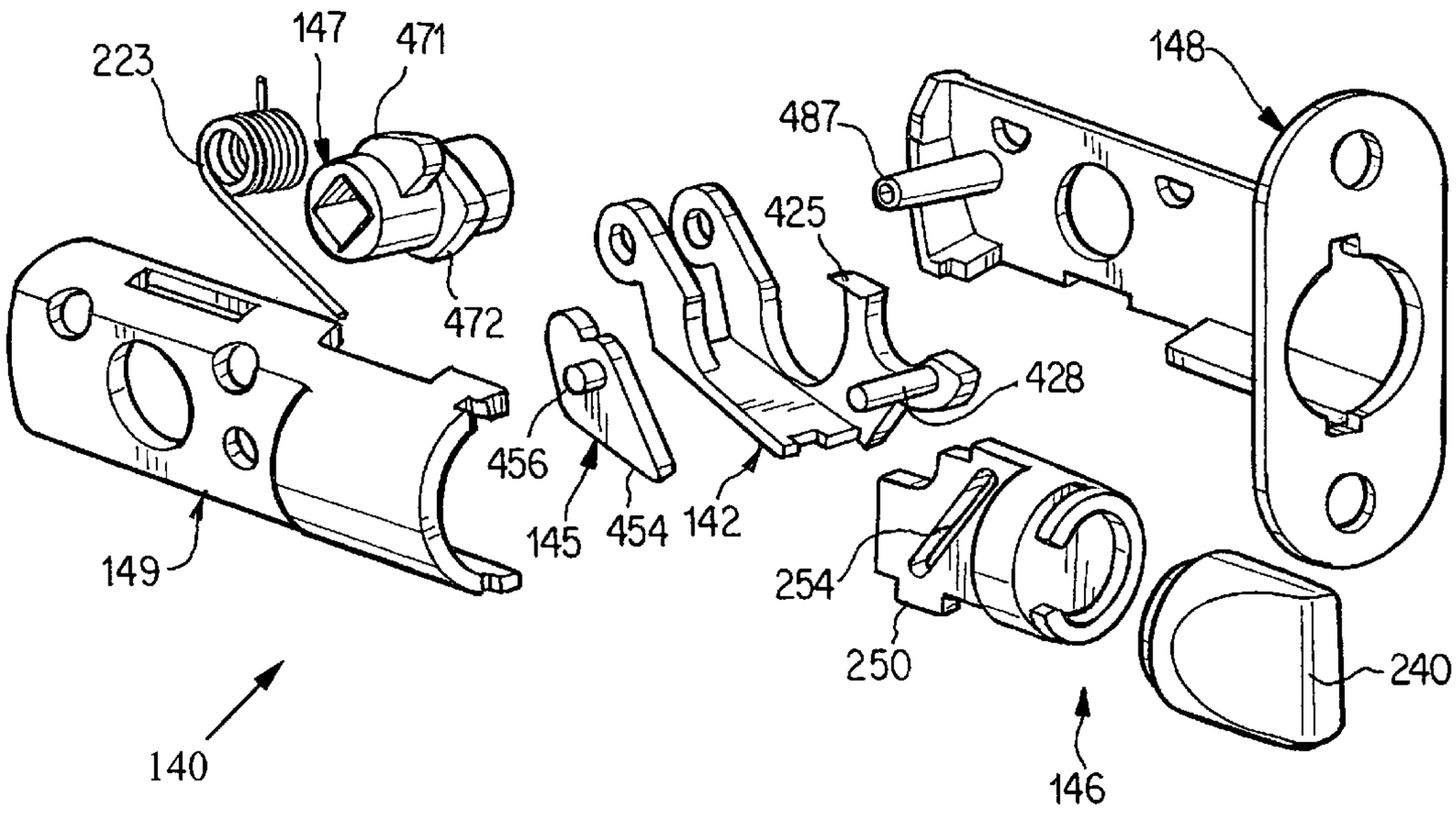
(57) **ABSTRACT**

A tubular latch assembly for a door and adapted for operation by either an "opener" such as a thumbpiece on one side and/or a knob on the other. The tubular latch comprises a central latch subassembly mounted inside the door and including a latch casing seated in the door, a bolt slidably mounted in said latch casing for extension/retraction (such as through an open face plate), a pivoting retraction lever coupled to the bolt, a spindle hub having a pair of offset cam surfaces, and a pivoting reversing lever engaged at one end with the bolt and at the other end with the second cam surface on the spindle hub for driving the bolt. The central latch subassembly allows opening by either the opener (e.g., thumbpiece) or by rotation of the knob, operation of the knob not affecting the opener and vice versa. This entirely eliminates any need for off-axis motion translation or accompanying mechanisms that are ordinarily used to adapt the axis of rotation of an opener to the orthogonal axis of rotation of a latch or spindle hub, thereby reducing the total number of parts as well as internal friction.

12 Claims, 11 Drawing Sheets



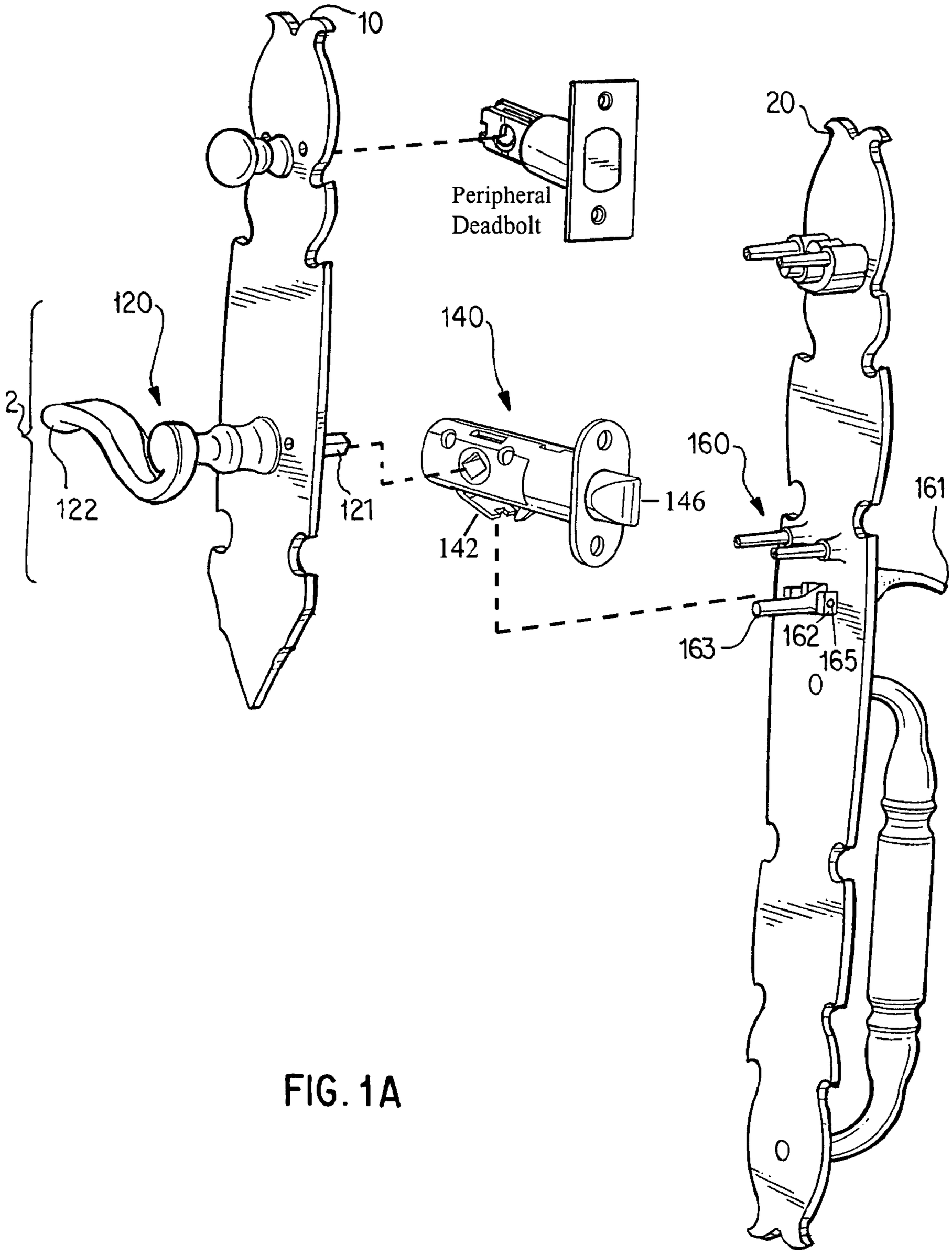

10
Peripheral
Deadbolt
120
2
122
121
140
142
146
160
161
163
162
165
20

FIG. 1A

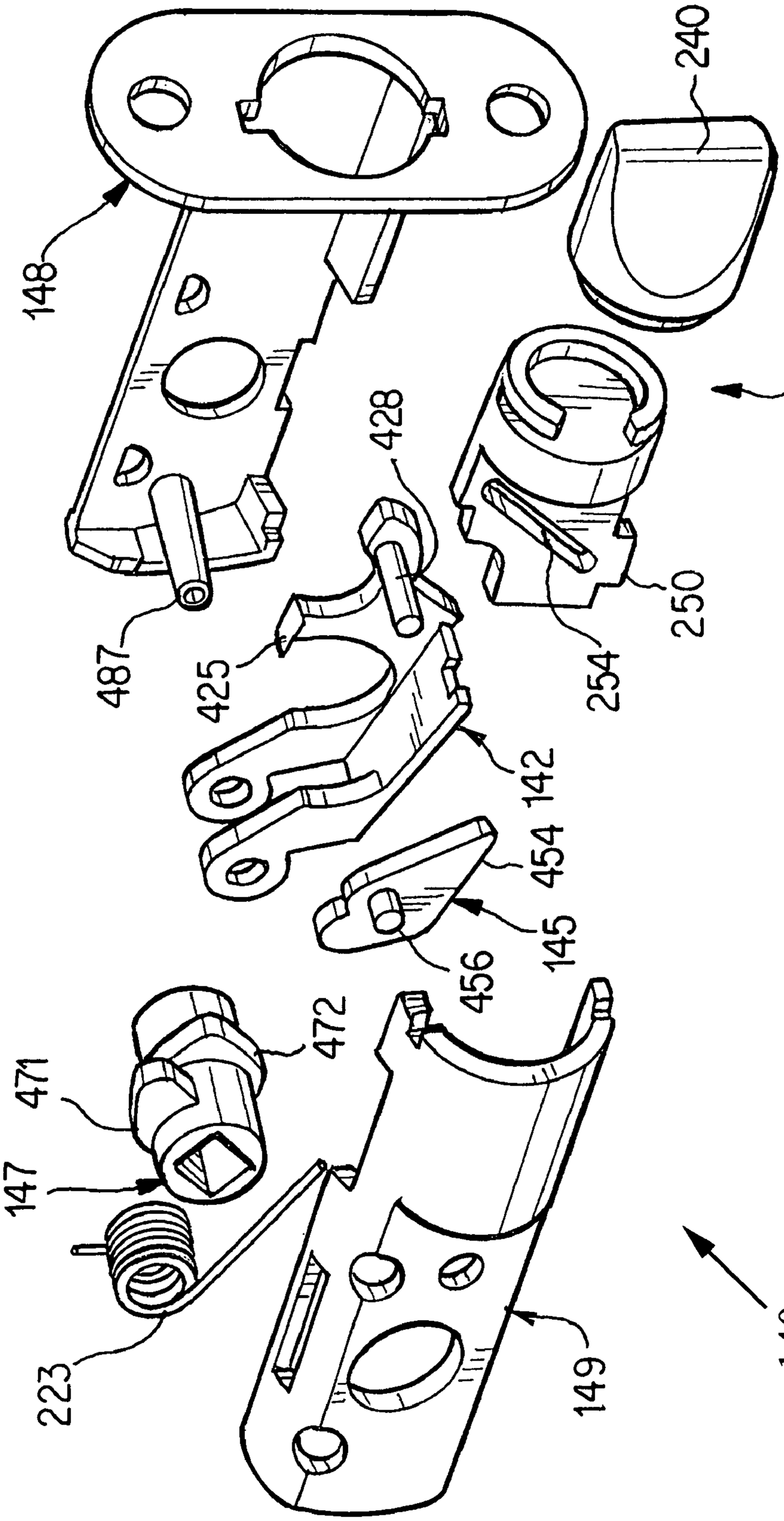

240
148
146
428
487
425
250
254
142
454
145
6
472
45
471
147
223
149
140

FIG. 1B

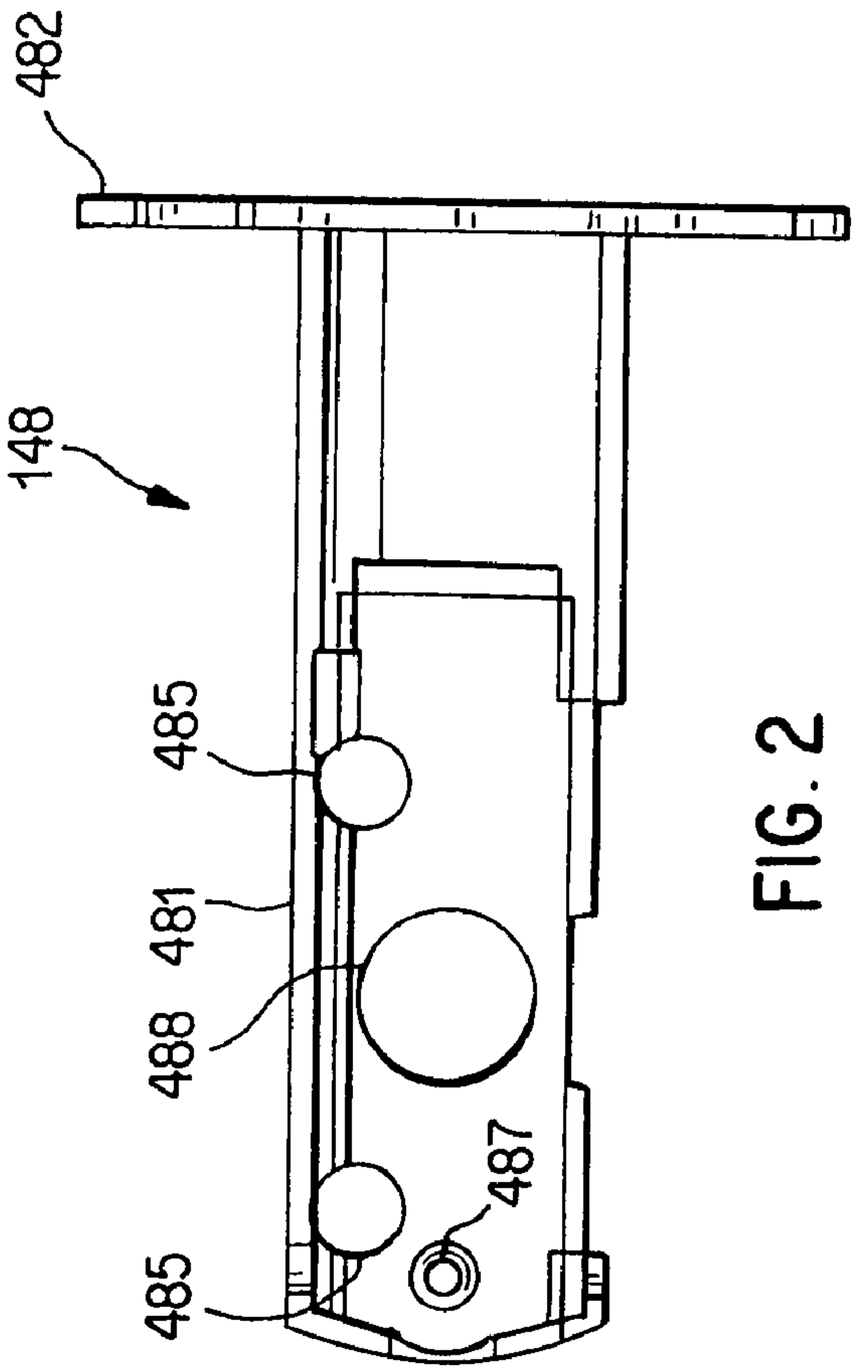


FIG. 2

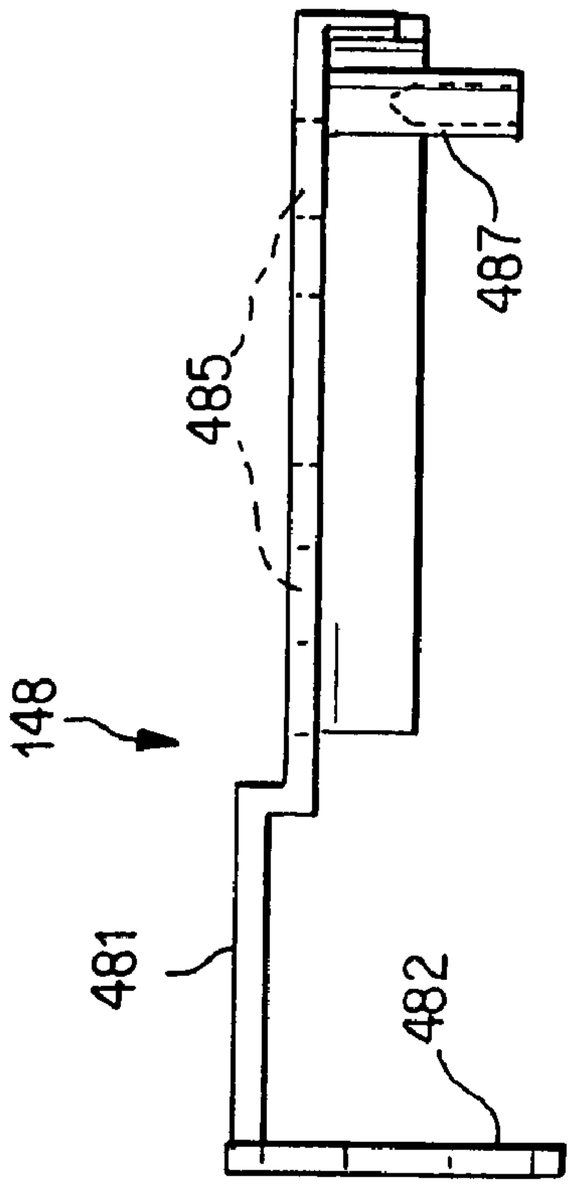


FIG. 3

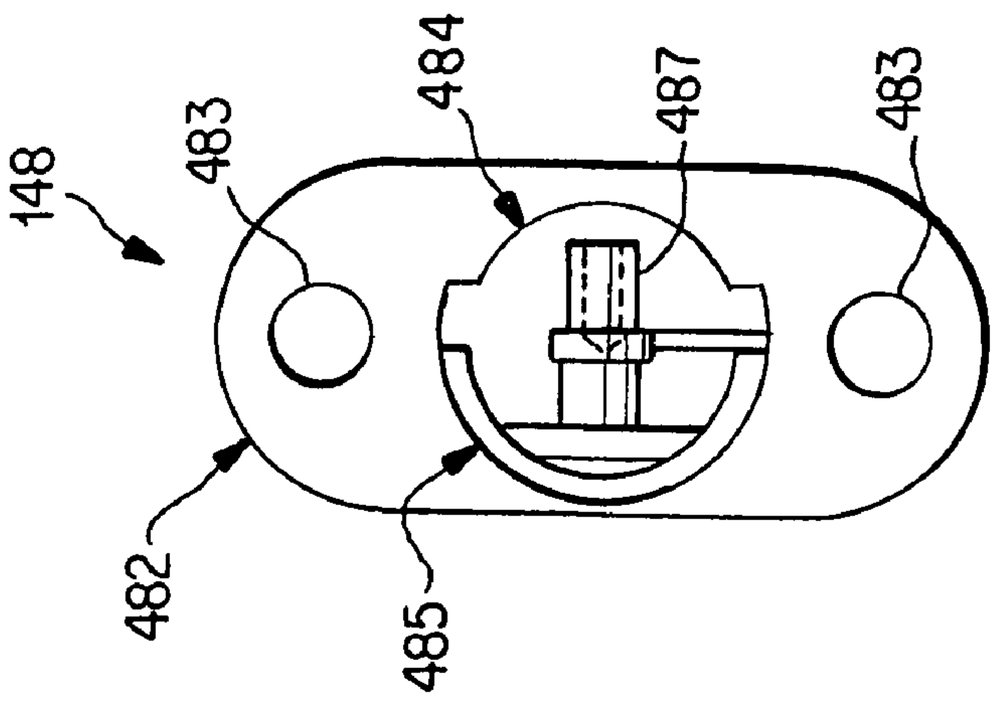


FIG. 4

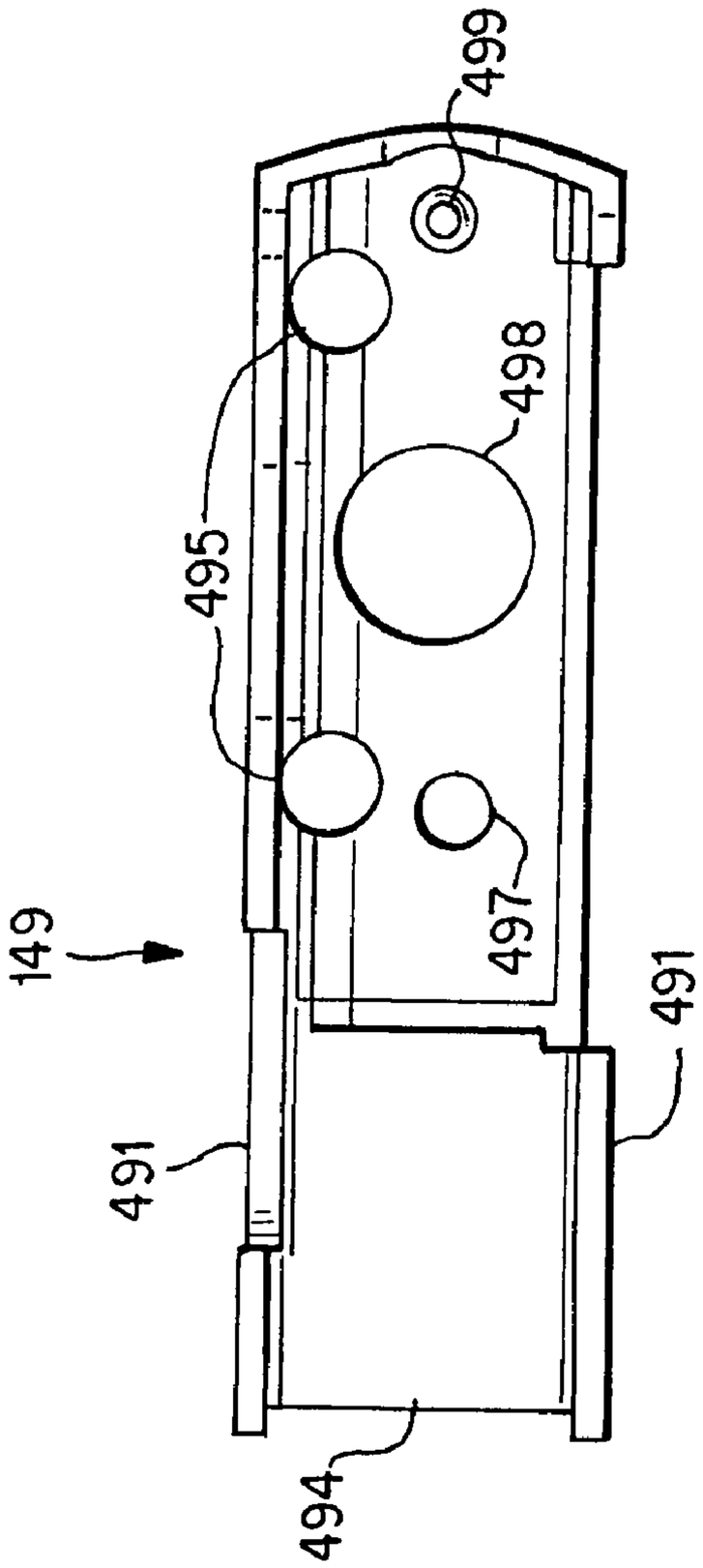


FIG. 5

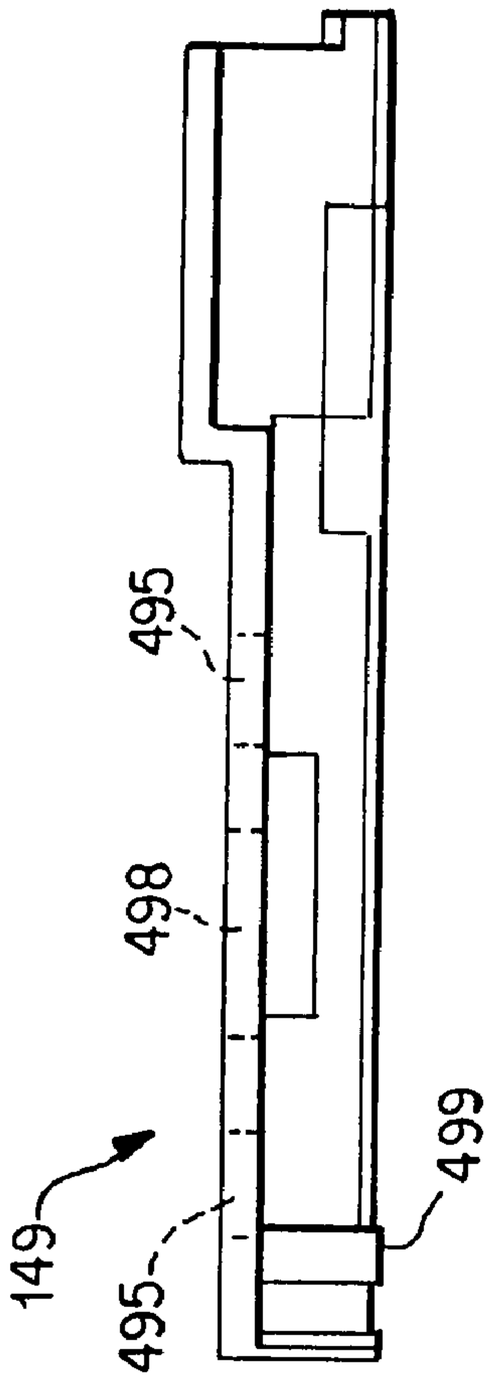


FIG. 6

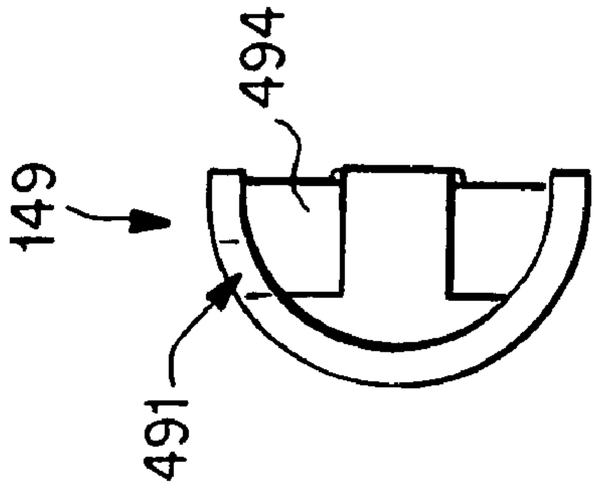


FIG. 7

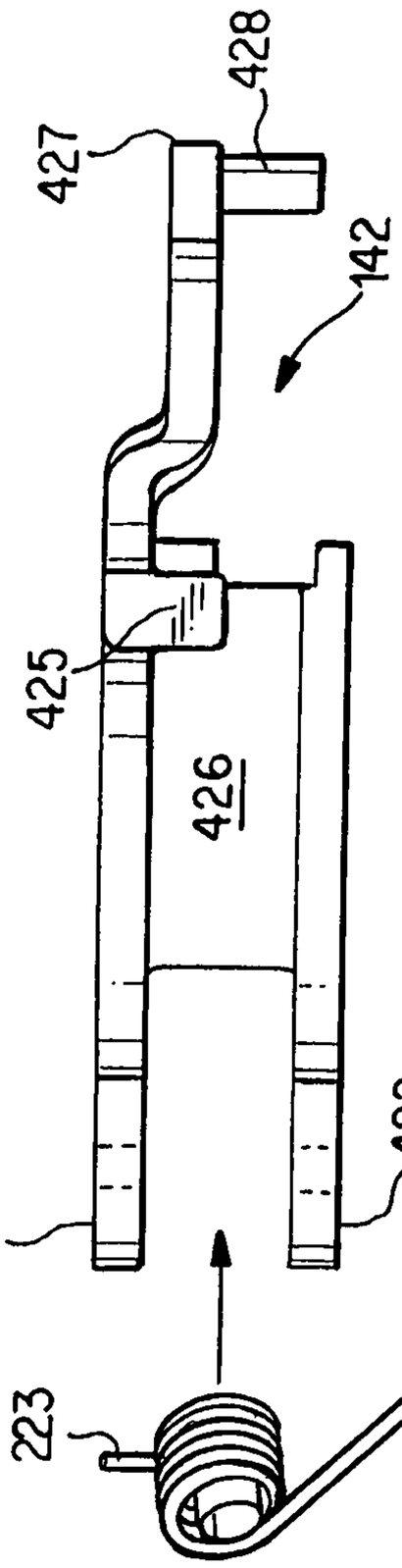


FIG. 8

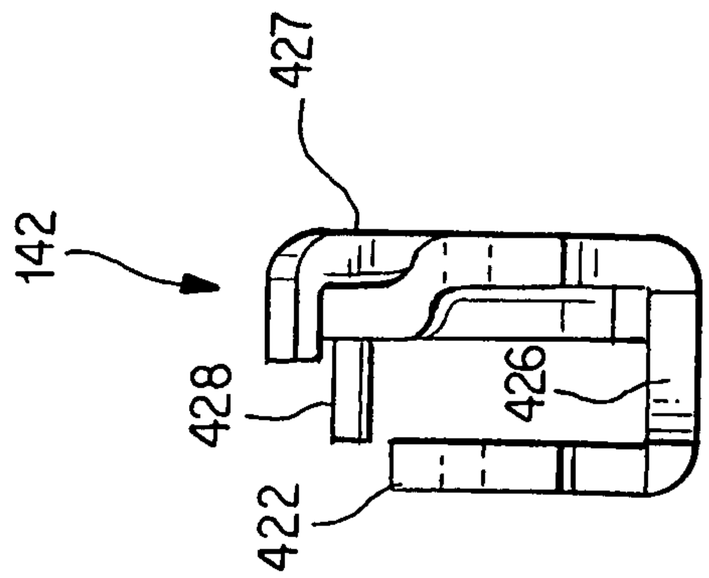
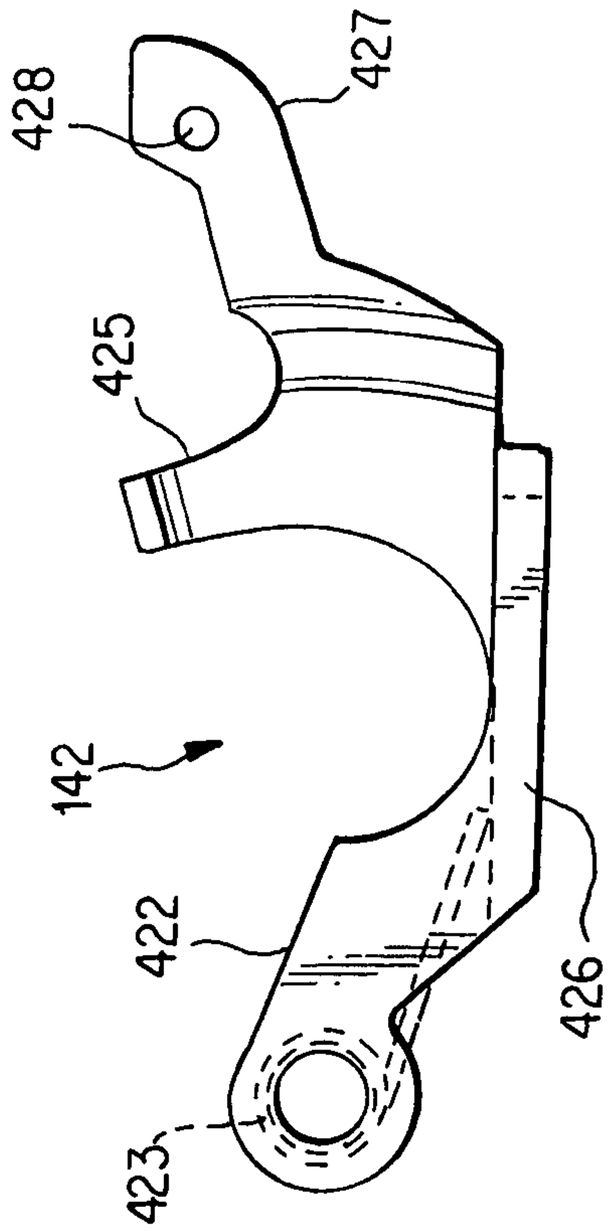


FIG. 10



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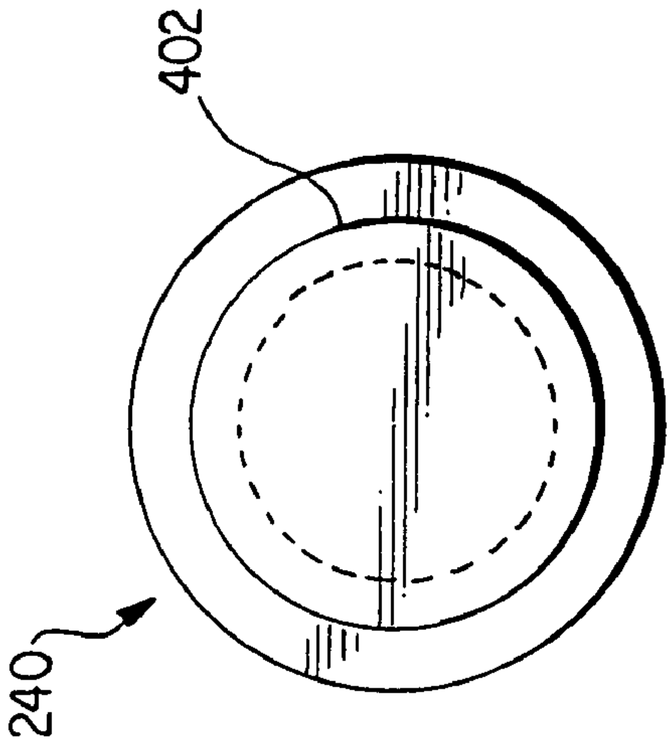

FIG. 13

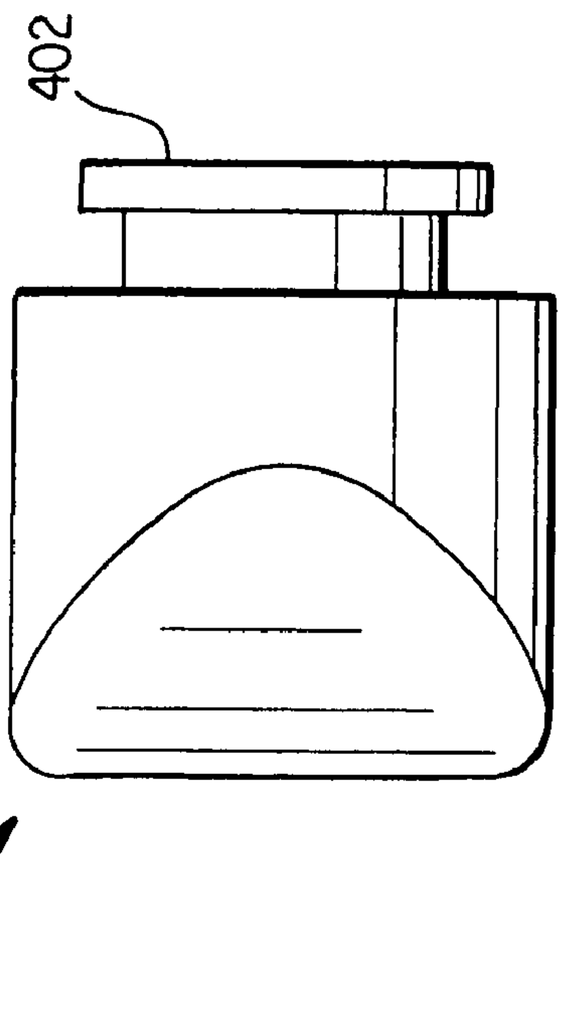

FIG. 11

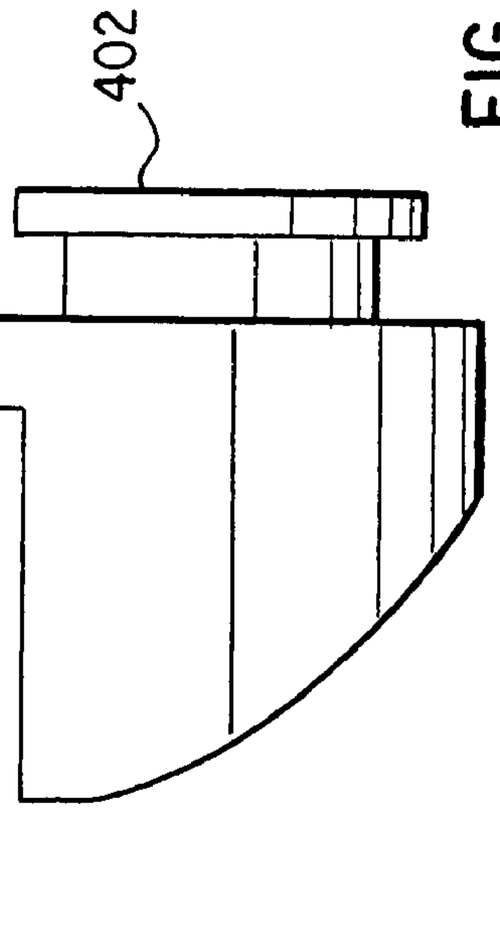

FIG. 12

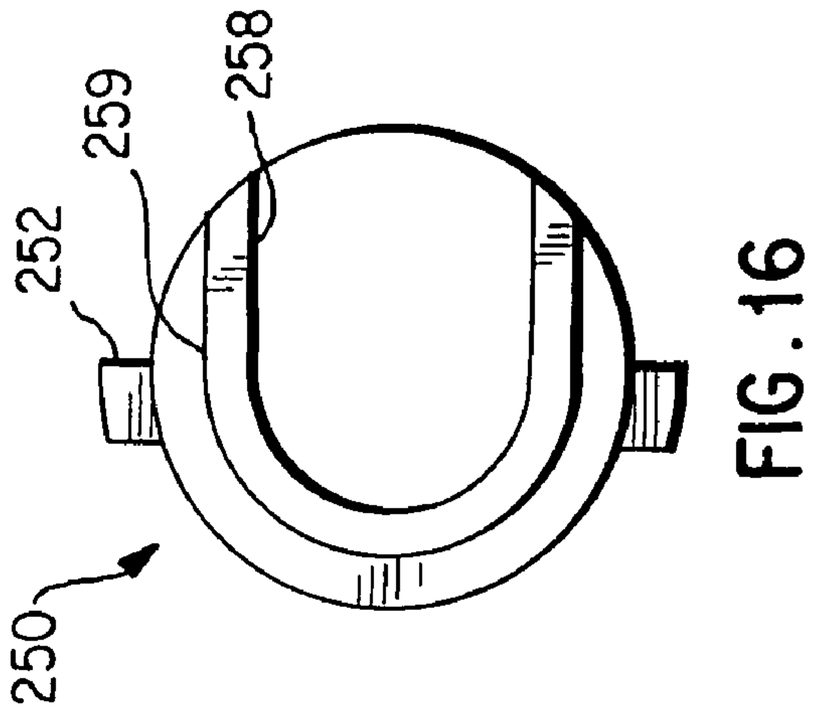

FIG. 16

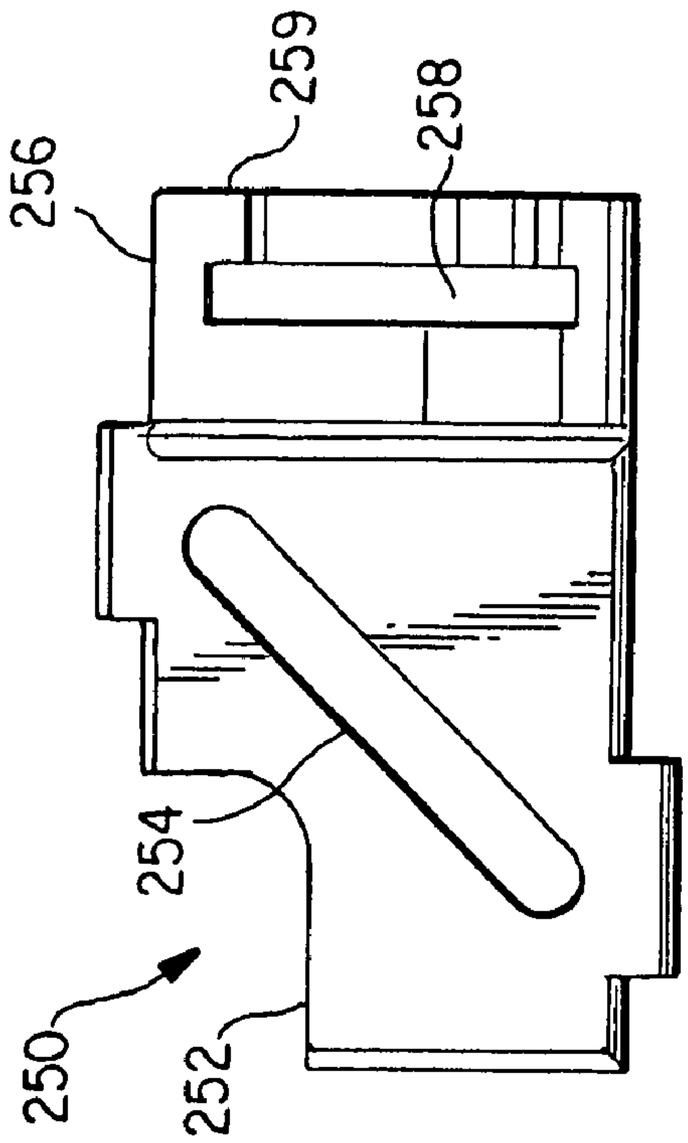

FIG. 14

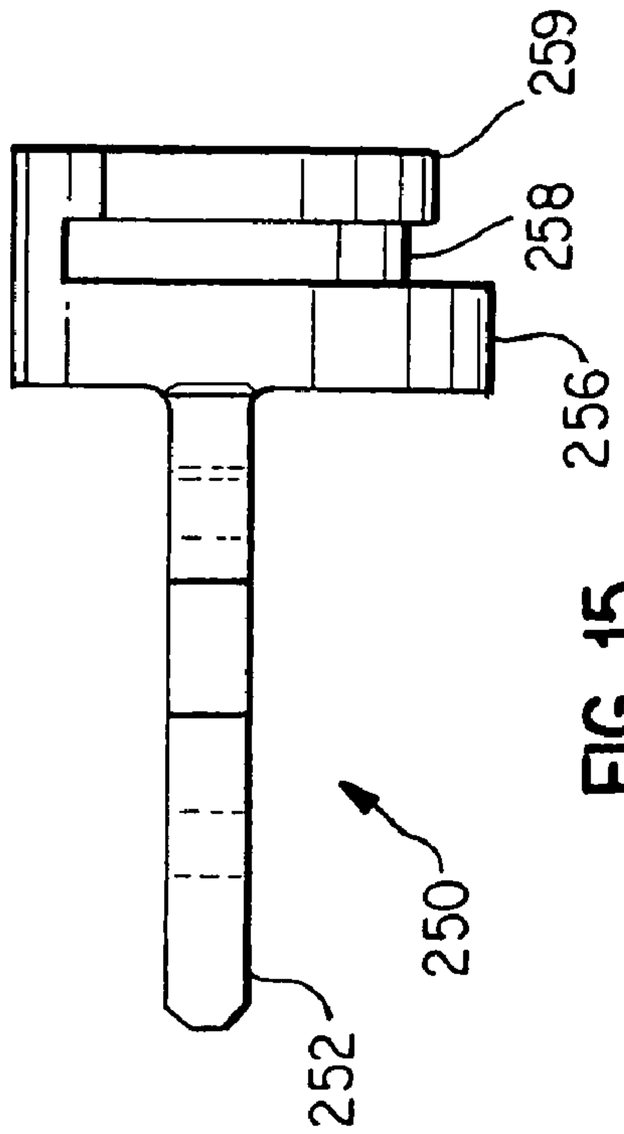

FIG. 15

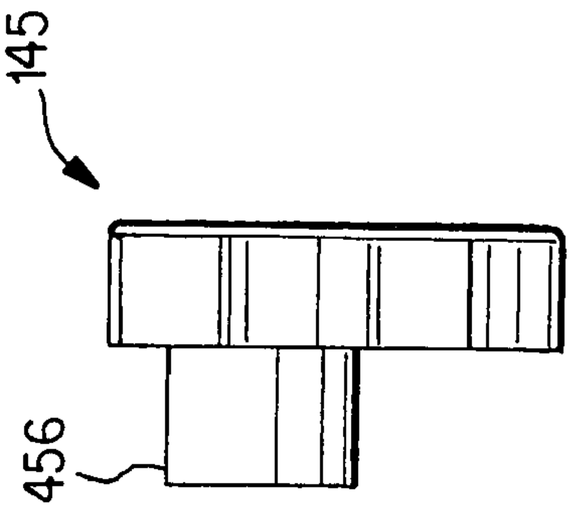

FIG. 18

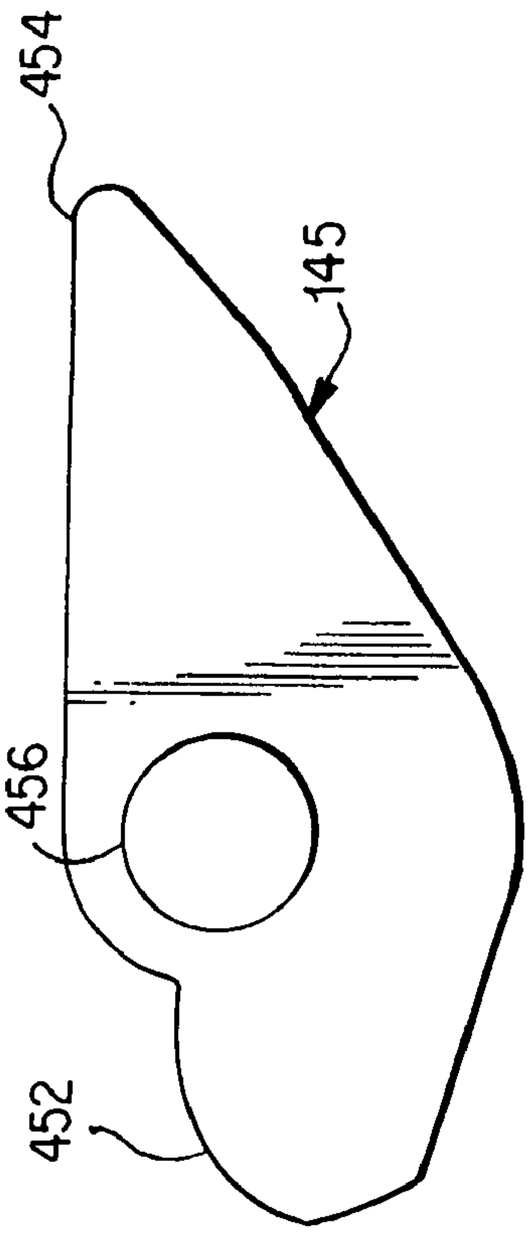

FIG. 17

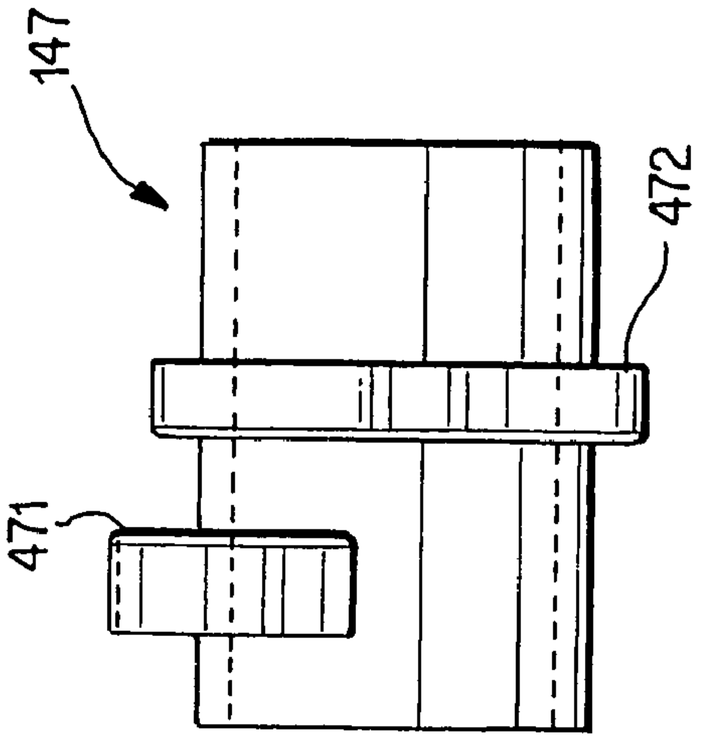

FIG. 20

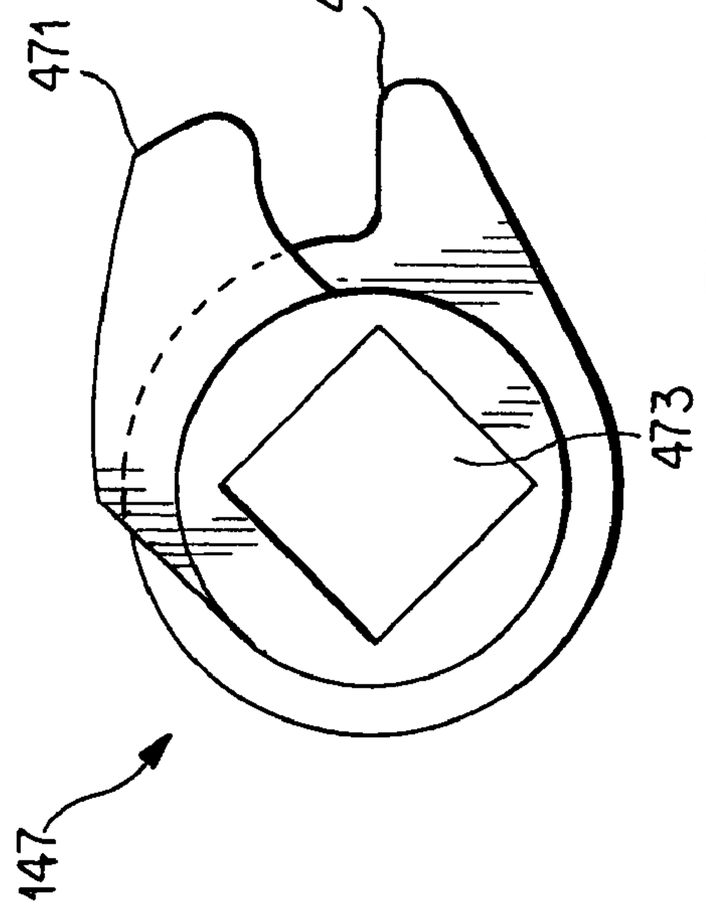

FIG. 19

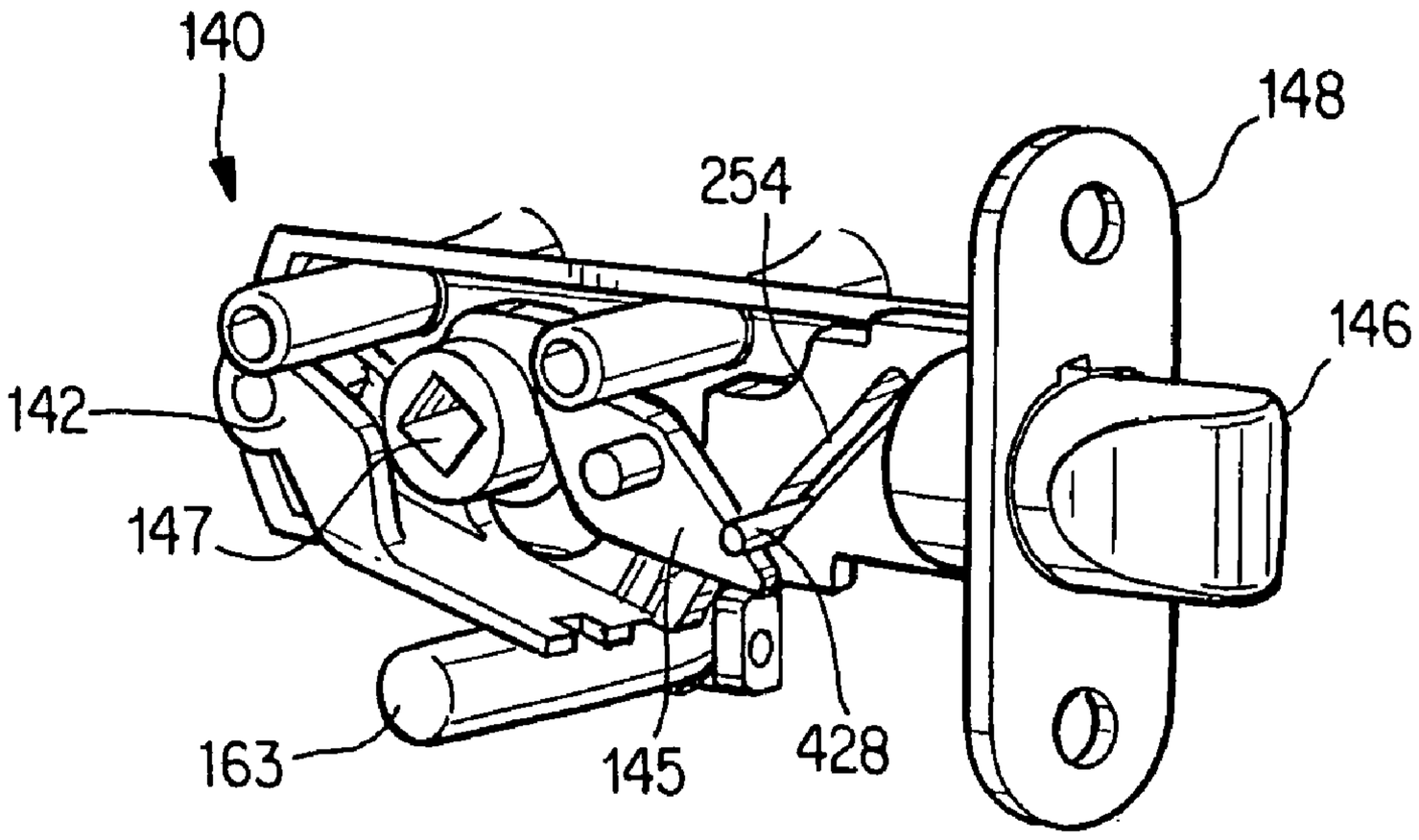

FIG. 21A

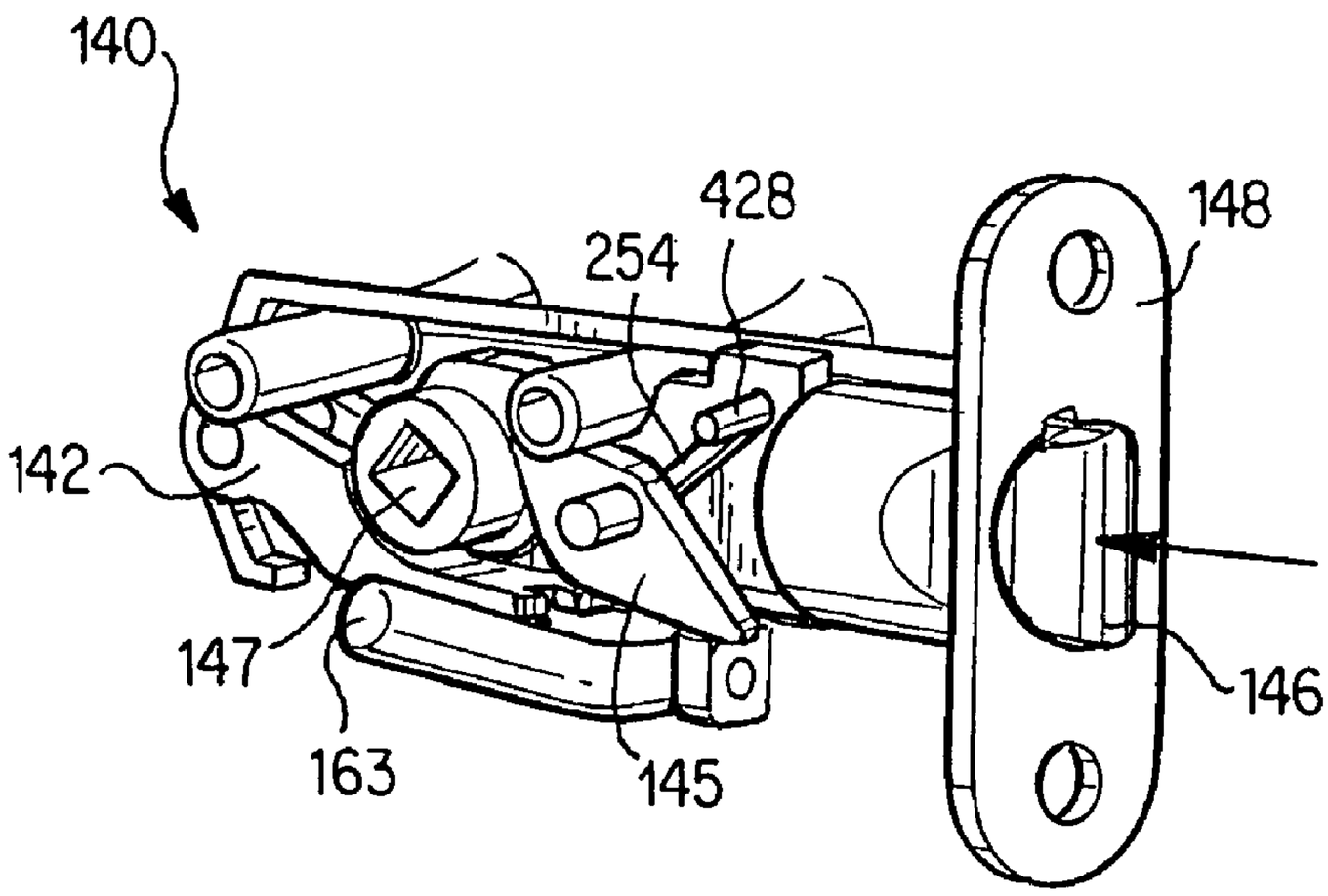

FIG. 21B

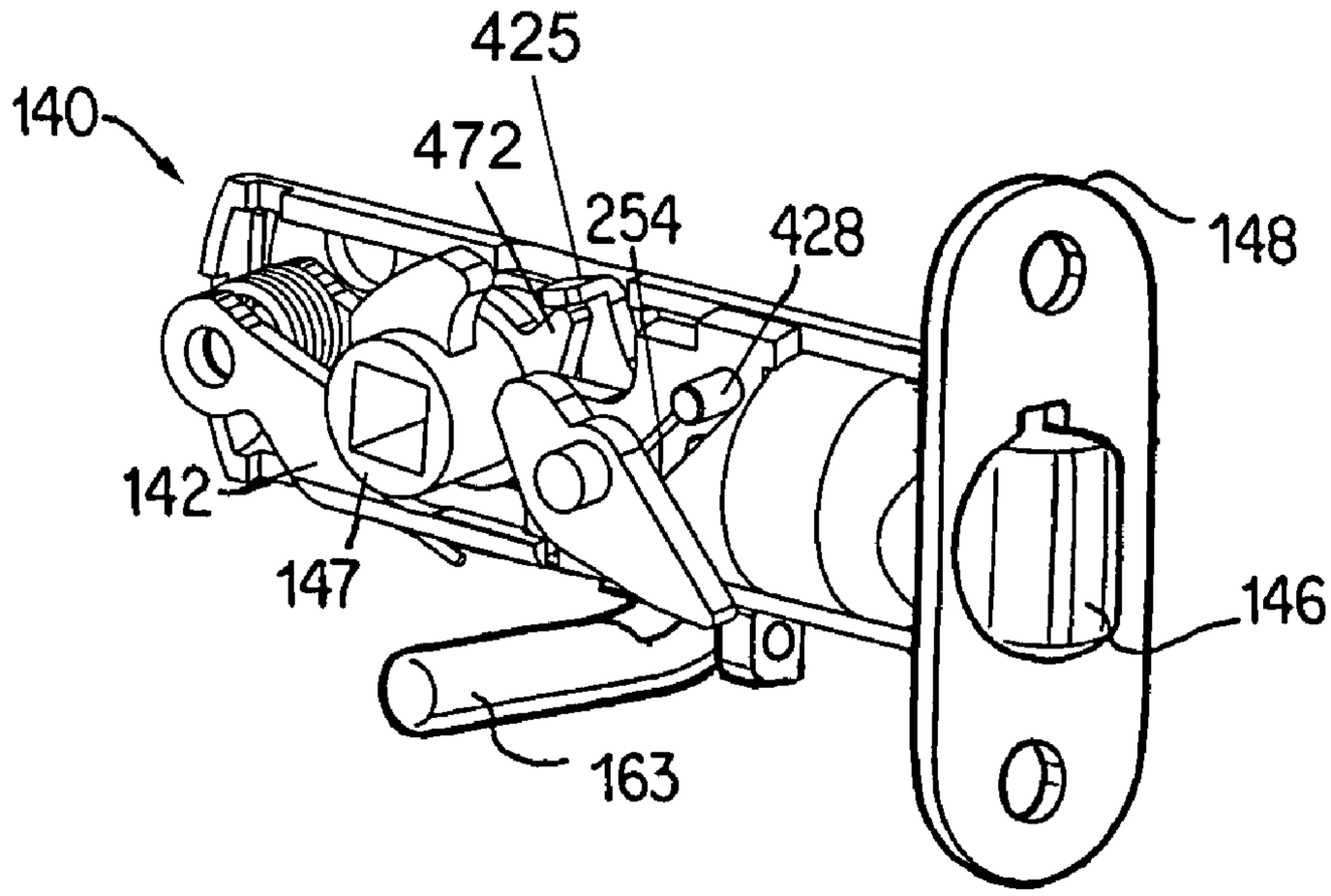

FIG. 21C

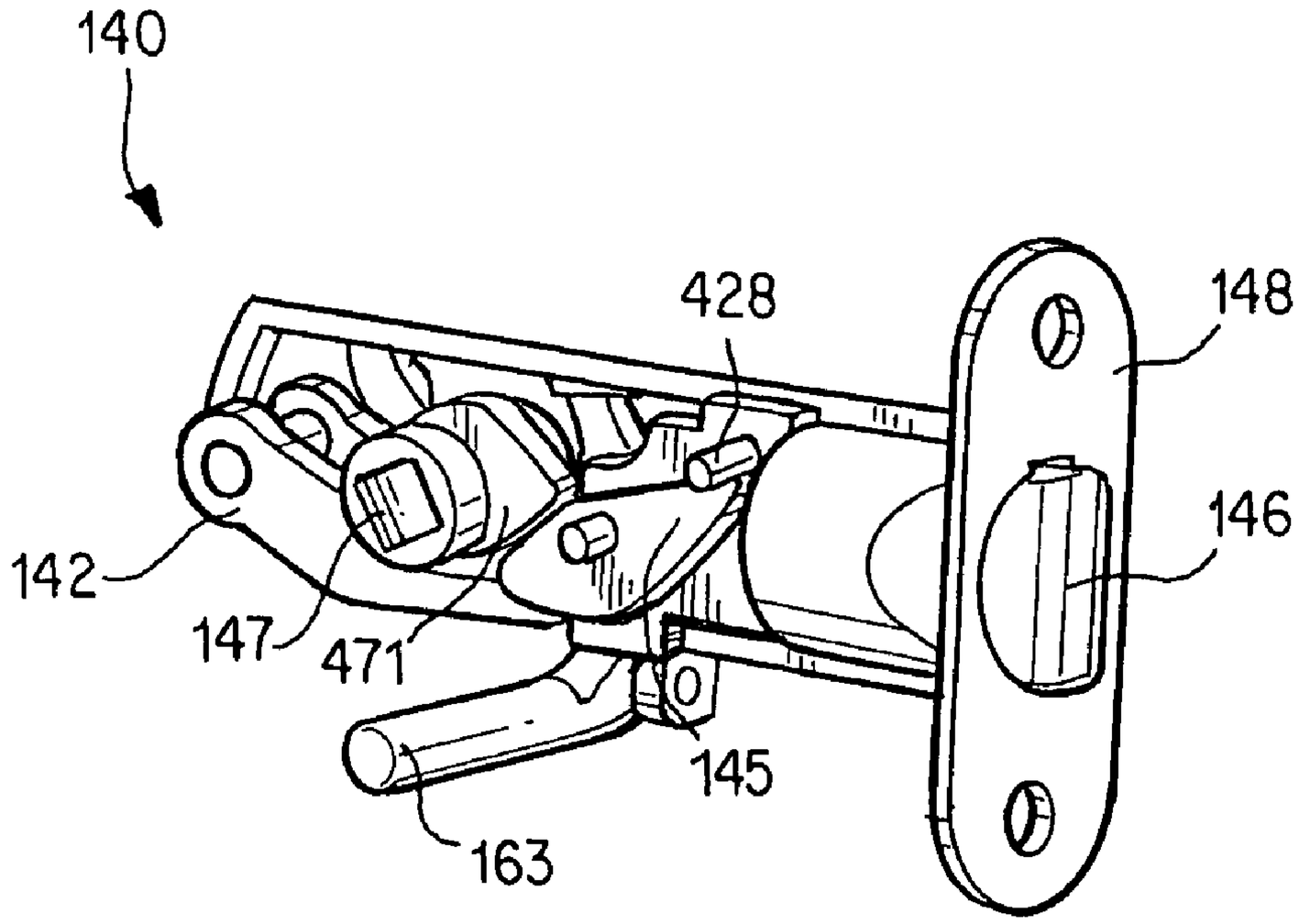

FIG. 21D

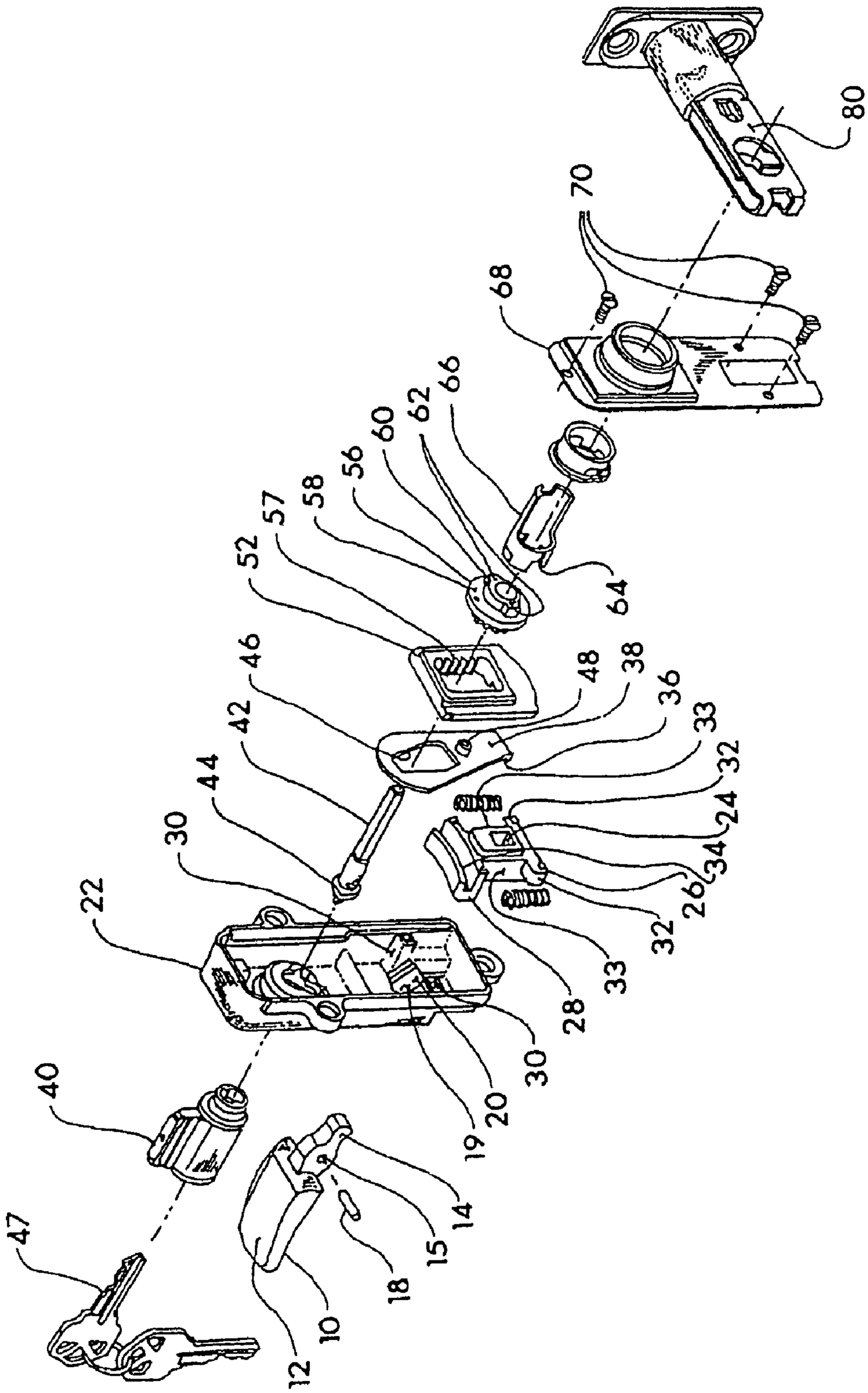

FIG. 22 PRIOR ART

TUBULAR LOCK LATCH ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is a continuation of U.S. application Ser. No. 11/542,358, filed 3 Oct. 2006.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to door locks and, more particularly, to a tubular latch assembly for use with handlesets or the like that is operable by movement of an opener such as a thumbpiece or the like.

2. Background of the Invention

Main entry doors on commercial and residential buildings are often equipped with exterior "handlesets", which consist of a handle or "pull" mounted on an escutcheon plate and a thumbpiece for operating the lock mechanism mounted above the handle, in such a way that the thumbpiece can be operated with the thumb while grasping the handle. Although a number of different lock mechanisms may be equipped with handlesets, the types known as tubular, or "bored through" locksets have become virtually universal in residential applications. Tubular handlesets are designed to be installed in an industry standard pattern of holes drilled in the edge and face of the door. Compared to traditional door preparation methods, such as cutting mortise pocket in the door edge, drilled door preps require substantially less time and skill. Unfortunately, they also impose constraints on the space available for the operating mechanism of the lock, and consequently make the mechanical design of the mechanism more difficult.

Latches are usually designed so that the latch bolt is retracted by the action of a slide bar that interacts with cams projecting from a hub or pair of hubs that rotate on an axis perpendicular to the direction of movement of the latch bolt. Other arrangements exist, but all work according to the same basic principle. The hubs are typically activated by a spindle attached to a knob or lever on the inside of the door, with an axis of rotation that is aligned with the axis of rotation of the latch hubs. When the latch is actuated by a handleset, however, the motion of the thumbpiece is essentially a vertical motion that acts perpendicular to the plane formed by the line of movement of the bolt and the axis of rotation of the hubs. A motion translator is therefore required to change the movement of the thumbpiece into a rotational motion that can be used to drive the latch hubs. So typically, the latch of a tubular handleset is operated by a spindle connected to a knob or lever on the inside and a spindle attached to a motion translator driven by the thumbpiece from the outside. In most cases, the latch has two hubs, one operated by each spindle, so that the inside and outside trims operate independently.

Another design issue in tubular handlesets is that, while it is desirable for a knob or lever to have 45 degrees or less rotation to assure a comfortable range of hand motion, reducing the hub rotation imposes unacceptably high load requirements at the thumbpiece, which is smaller than the knob or lever, making it more difficult to apply a force necessary to operate the latch. This is especially true in situations where there is a warped door or tight weather stripping. In addition to affecting the effort required to operate the thumbpiece, forces experienced by the components of the motion translator are high, increasing internal friction and making the components more likely to break. The problem may be overcome

by making the range of movement of the thumbpiece very large, but that is undesirable for both mechanical and ergonomic reasons.

Another effect of using a motion translator between the thumbpiece and the latch is an increase in the number of components in the lockset. For example, FIG. **22** is a prior art illustration from U.S. Pat. No. 5,513,510 to Solovieff et al. showing an exemplary handleset with thumbpiece and rack that requires a motion translation mechanism, and particularly gear pieces **52**, **56** to change the vertical motion of the thumbpiece **10** to the rotary motion of the latch hub **66**. Referring to FIG. **22**, it can be seen that item **32**, **33**, **52** and **58** are required only for translation of the motion of thumbpiece **10** to rotation to operate latch **80**. These components add cost, both in the cost of the component itself and added assembly cost of the mechanism. They also increase internal friction through contact between the parts and in the bearings and surfaces required to guide them, and decrease reliability as the parts are small and are difficult to manufacture and assemble correctly.

It would be greatly advantageous to provide a latch that allows for direct actuation by a thumbpiece (or other opener) without an intervening motion translation mechanism. It would also be desirable to have such a latch that could also be independently actuated by a spindle attached to a knob or lever, and which could be operated in either direction to accommodate use with knobs or, in the case of levers, both left hand and right hand operation.

SUMMARY OF THE INVENTION

It is, therefore, the primary object of the present invention to provide for direct operation of a tubular latch by an opener (e.g., thumbpiece, or the like), eliminating any need for off-axis motion translation or accompanying mechanisms that are ordinarily used to adapt the axis of rotation of the opener (e.g., thumbpiece or the like) to the axis of rotation of a latch hub.

It is another object to reduce the total number of parts and internal friction normally associated with prior art tubular latches requiring a motion translator for an off-axis thumbpiece, thereby providing smoother operation, reduced cost and improved reliability.

It is still another object to provide a tubular latch that can be directly operated by a thumbpiece or the like on one or both sides of the door, and also can be independently operated by a spindle driven by a knob or lever on the inside, where operation by knob or lever does not affect the thumbpiece, and vice-versa.

It is still another object to provide a tubular latch with a less-than-45-degree range of knob (or spindle) rotation without adversely affecting the amount of motion or force required to operate the thumbpiece, effectively making the thumbpiece operation independent of the latch hub.

In accordance with the foregoing objects, the present invention is a latch that allows opening by a handleset thumbpiece from outside the door, and any of a handleset thumbpiece or lever, or alternately a knob from inside the door, the motion of the two not affecting one another.

The tubular latch generally comprises a central latch subassembly mounted inside the door and including a latch casing secured inside the door (and opening through edgewise to the door), a bolt slidably mounted in said latch casing for extension/retraction, a pivoting retraction lever coupled to the bolt for camming the bolt. The retraction lever can be pivoted from either side of the door to open the bolt using opposing handleset thumbpieces on both sides of the door (a "back-to-

back" mount) or, alternatively, by a handleset thumpiece on one side and a rotary knob or lever on the other side. In the latter case, a spindle hub is rotatably mounted in the latch casing, the spindle hub having a cam surface for engaging the retraction lever. This allows opening by either the thumbpiece or by rotation of the knob, operation of the knob not affecting the thumbpiece and vice versa.

The central latch subassembly may be adapted for bi-directional operation of the spindle hub, depending on the application, by inclusion of a second cam surface on the spindle hub and a pivoting reversing lever engaged at one end with the bolt or with the retracting lever and at the other end with the second cam surface on the spindle hub.

The foregoing latch subassembly entirely eliminates any need for off-axis motion translation or accompanying mechanisms that are ordinarily used to adapt the axis of rotation of a thumbpiece to the orthogonal axis of rotation of a latch or spindle hub, thereby reducing the total number of parts as well as the internal friction normally associated with the motion translator.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features, and advantages of the present invention will become more apparent from the following detailed description of the preferred embodiments and certain modifications thereof when taken together with the accompanying drawings in which:

FIG. **1**(A) is a composite exploded view of a handleset **2** as installed between an inside escutcheon **10** and outside escutcheon **20** of a door.

FIG. **1**(B) is an enlarged exploded illustration of the central latch subassembly **140** as in FIG. **1**(A).

FIGS. **2-4** are an inside view, top view and front end view, respectively, of the right side casing half **149** of FIG. **1**B.

FIGS. **5-7** are an inside view, top view and front end view, respectively, of the left side casing half **148** of FIG. **1**B.

FIGS. **8-10** are a top view, side view and end view, respectively, of the retraction lever **142** of FIG. **1**B.

FIGS. **11-13** are a bottom view, side view and end view, respectively, of bolt head **240** of bolt **146** of FIG. **1**B.

FIGS. **14-16** are a side view, top view and front end view, respectively, of the ramp attachment **250** of bolt **146** of FIG. **1**B.

FIGS. **17-18** are a side view and end view, respectively, of the reversing lever **145** of FIG. **1**B.

FIGS. **19-20** are a side view and front view, respectively, of the spindle hub **147** of FIG. **1**B.

FIG. **21** (A-D) is a composite sequential illustration of the operation of the central latch subassembly **140**.

FIG. **22** is a prior art illustration from U.S. Pat. No. 5,513,510 to Solovieff et al. showing an exemplary handleset with thumbpiece and rack that requires a motion translation mechanism.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is a tubular latch that allows for retraction of the latch by direct action of a thumbpiece (or any other "operator"), without any intermediate off-axis motion translation mechanisms, or by operation of a knob or lever turning a spindle hub within the latch. The latch according to the present invention is herein described in the context of a typical handleset including exterior escutcheon, handle and thumbpiece, though other configurations are readily possible in which a bolt is slidably moved along an axis alternately by some form of opener (including knob or lever) turning along a perpendicular axis of rotation and/or by another form of operator (such as a pivoting thumbpiece) pivoting about an axis parallel to that of the bolt movement, without any intermediate off-axis motion translation mechanisms.

FIG. **1**(A) is a composite exploded view of the central latch subassembly **140**, installed between the inside subassembly **120** and the outside subassembly **160** of handleset **2**. A peripheral deadbolt at top is not a part of the present invention. Subassembly **120** is for opening/closing the door from inside, outside subassembly **160** including thumbpiece **161** is for opening/closing the door from outside.

The thumbpiece **161** pivots on a yoke **162** about a pivot axis, the yoke **162** being secured to the outside escutcheon **20**. The rear of the thumbpiece **161** wields an extension **163** that enters the escutcheon **20**, and is secured by a pivot pin **165**, thus downward movement of **161** by thumb results in an upward movement of extension **163**. As the extension **163** rocks upward it bears against the bottom of a retraction lever **142** (see below) attached as part of central latch subassembly **140** and pushes it upward when the thumbpiece **161** is depressed, in turn retracting the bolt **146**.

FIG. **1**(B) is an enlarged exploded illustration of the central latch subassembly **140** as in FIG. **1**(A), inclusive of the retraction lever **142**. When the retraction lever **142** moves upward, a lateral pin **428** at its forward end slides upward along a ramped rearward surface of aperture **254** formed in the tail **250** of bolt **146**, thereby camming the bolt **146** backward along a linear axis of movement so that it retracts into the case formed by halves **148**, **149**, and allowing the door to open. The retraction lever **142** is pivoted on a screw stem **487** that lies in the case **148**, **149**.

In a simple form of the present invention this retraction lever **142** is all that is needed to cam the bolt **146**. An identical thumbpiece **161**, extension **163** and escutcheon **20** can be mounted on the inside of the door (thereby giving a "back-to-back" mount of opposing handlesets/thumbpieces, wherein the retraction lever **142** may be pivoted from both sides by direct actuation of the respective thumbpieces. However, the embodiment as shown in FIGS. **1**(A&B) and further described herein uses a rotary knob **122** or lever attached to the inside escutcheon **10**, and a rotary knob **122** rotates a spindle hub **147** about an axis of rotation, and the spindle hub **147** engages the retraction lever **142**. The spindle hub **147** is disposed for pivoting about a pivot axis that is parallel to that of the retraction lever, and perpendicular to the linear axis of movement of said bolt. A torsion spring **223** is loaded onto the screw stem **487** between the pivot arms of the retraction lever **142** to bias it down to its home position. In the current embodiment, the aperture is in the form of a groove with a ramped forward surface which is acted on by lateral pin **428** to extend the bolt as retracting lever returns to its home position. The aperture could just as well be constructed in such a way that only the rearward surface is ramped to engage pin **487**. In such a construction, the bolt would be retracted by action of pin **487** against the ramp, but would be equipped with independent springs to return it to the extended position when retracting lever **142** returned to its home position.

The spindle hub **147** is rotatably seated across the halves **148**, **149** of the latch case, and hub **147** is broached to accept a spindle **121** protruding inward from the knob **122** or lever that is attached to the inside escutcheon **10**. The spindle hub **147** is defined by two forward cam surfaces **471**, **472** which are axially offset from each other. When the spindle hub **147** is rotated counterclockwise, the inner cam surface **472** (closest to the retraction lever **142**) will bear upward against a lateral lug formed in a lifter arm **425** at the forefront of

retraction lever **142**, thereby lifting retraction lever **142** and retracting the bolt **146**. Conversely, when the spindle hub **147** is operated clockwise the outer cam surface **471** engages one end of a pivoting reversing lever **145**. The reversing lever **145** extends to a lift arm **454** that engages the lateral pin **428** of the retraction lever **142** (see also FIGS. **8** and **9**), thereby lifting the retraction lever **142**, and in turn camming the bolt **146** back so that it retracts into the case formed by halves **148**, **149**, thereby allowing the door to open. The thumbpiece **161** is not affected. Note also that when the retraction lever **142** is fully retracted, it remains flush with the bottom of the latch case **148**, **149** to allow the latch to be installed in the edge bore of the door.

FIGS. **2-4** are an inside view, top view and front end view, respectively, of the right side casing half **148** of FIGS. **1**(A&B). The right side casing **148** generally comprises a unitary member having an oblong face plate **482** defined by a central bolt aperture **484** flanked on top and bottom by opposing securement holes **483** for screw-attachment to a doorjamb. The face plate **482** is integrally joined to a rearwardly protruding casing wall **481** which serves as a half-enclosure for the internal components. Casing wall **481** is further defined by a spindle aperture **488** flanked by opposing securement holes **485** (these securement holes **485** receiving stems formed on the outside escutcheon for mounting), and an inwardly protruding screw stem **487** for securement to the left side casing half **149**. When mounted as shown in FIG. **1**(A), the retraction lever **142** pivots on screw stem **487**.

FIGS. **5-7** are an inside view, top view and front end view, respectively, of the left side casing half **149** of FIG. **1**(B). The left side casing **149** generally comprises a unitary semi-cylindrical wall **491** defined by a bolt aperture **494** at one end. The casing wall **491** likewise serves as a mating half-enclosure (with right casing **148**) for the internal components. Casing wall **491** is further defined by a spindle aperture **498** flanked by opposing securement holes **495**, and a pivot hole **497** for mounting the reversing lever **145**. As is apparent, the left and right side casings **148**, **149** come together and are secured by a screw in screw stem **499** (which also passes through screw stem **487** in the right side casing **148**) to enclose the internal components to be described. When mounted as shown in FIG. **1**(A), the reversing lever **145** pivots on pin **456** (see FIG. **1**B) inserted in pivot hole **497**.

FIGS. **8-10** are a top view, side view and end view, respectively, of the retraction lever **142** of FIG. **1**B.

As best seen in FIG. **9**, retraction lever **142** may be formed as a unitary member with five primary sections including a parallel pair of upwardly raised pivot arms **422**, each wielding a collar **423**, a flat central section **426** for abutting the thumbpiece extension **163**, an upwardly turned lifter arm **425** with furled over lug at the distal tip to provide a bearing surface for cam **472** of spindle hub **147**, and a forwardly reaching neck **427** defined by the distal lateral pin **428**. As seen in FIGS. **8** and **10** retraction lever **142** may be formed with pivot arms **422** integrally joined to flat central section **426**, the central section **426** being extended on one side to lifter arm **425** and on to neck **427**. The flat central section **426** remains accessible to the extension **163** at the bottom of the combined casing halves **148**, **149**. The pivot arms **422** of retraction lever **142** are carried on screw stem **487** as seen in FIG. **1**(B), and a torsion spring **223** is also carried on the screw stem **487** between the pivot arms **422** of the retraction lever **142** as seen in FIG. **9** to bias it downward to its home position.

The bolt **146** of FIG. **1**A, as seen in FIG. **1**B, further comprises a bolt head **240** having a tail **250** defined by the ramped aperture **254**. The bolt **146** may be formed as a unitary component or discrete interfitting components. For purposes of illustration the depicted bolt **146** comprises a discrete bolt head **240** that removably mates with a discrete tail **250**, though this detachment ability is optional.

FIGS. **11-13** are a bottom view, side view and end view, respectively, of bolt head **240** of bolt **146** of FIG. **1**B. The bolt head **240** includes a standard bolt face for slidable engagement with a plate installed in a doorjamb in a conventional manner. However, in this case the bolt face is formed with a rearwardly protruding stem **402** having a circular annular flange for insertion in a receptacle in the tail attachment **250**.

FIGS. **14-16** are a side view, top view and front end view, respectively, of the tail attachment **250** of bolt **146** of FIG. **1**B. The tail attachment **250** comprises a T-shaped member as seen in FIG. **15** having an annular stirrup **256** for releasably anchoring the stem **402** of bolt head **240**. The stirrup **256** is formed as an annular member with an inner annular open-topped notch **258** that leads outward past lips **259** for slidable insertion of the stem **402** of bolt head **240**. The lips **259** form a radial flange around the stem **402** for holding it captive therein. The stem **402** can be easily removed by lifting it out of the notch **258**, but when inserted essentially lock the bolt head **240** and ramp attachment **250***m* together in one integral bolt **146**.

The stirrup **256** is integrally joined (orthogonally) with a flat slide plate **252** defined by the ramped aperture **254**. The pin **428** of neck **427** of lever **142** traverses the aperture **254** and as the lever **142** pivots the neck **427** up and down, this urges the slide plate **252** (vis a vis pin in notch **254**) backward and forward. This effectively moves the bolt head **240** in and out of engagement with the plate installed in the doorjamb to unlatch the door.

FIGS. **17-18** are a side view and end view, respectively, of the reversing lever **145** of FIG. **1**B. Reversing lever **145** generally comprises a protruding pin **456** attached to an eccentric member with a cam surface **452** on one side and an extended lift arm **454** on the other. As seen in FIG. **5** the reversing lever **145** is pivotally seated by pin **456** in the pivot hole **497** of the left side casing **149**. The cam surface **452** is exposed rearwardly for engagement with the spindle hub **147**, while the lift arm **454** protrudes forwardly through the retraction lever **142** for engaging the pin **428** of lever **142** and pivoting it. Thus, when the spindle hub **147** rotates counterclockwise the inner cam surface **472** (closest to the retraction lever **142**) will bear upward against the lifter arm **425** of retraction lever **142**, thereby lifting retraction lever **142**. This in turn urges the tail **252** of the bolt **146** (vis a vis pin in aperture **254**) backward. This in turn moves the bolt head **240** in and out of engagement with the plate installed in the door jamb to unlatch the door.

FIGS. **19-20** are a side view and front view, respectively, of the spindle hub **147** of FIG. **1**B. The spindle hub **147** comprises a bushing that is rotatably seated in the central apertures **488**, **498** of the right and left side casings **148**, **149**, respectively. The spindle hub **147** is a generally annular member with a pair of radially-protruding cams **471**, **472**. The two cams **471**, **472** are offset axially as seen in FIG. **20**. When the spindle hub **147** is rotated clockwise cam **471** engages one end of reversing lever **145**, which pivots, and the extended lift arm **454** at the other end of reversing lever **145** engages the lateral pin **428** of the retraction lever **142** (see FIGS. **8** and **9**). This lifts the retraction lever **142**, which cams the bolt **146** back so that it retracts into the case formed by halves **148**, **149**, thereby allowing the door to open. Conversely, when the spindle hub **147** rotates counterclockwise the inner cam surface **472** does the work, bearing upward against the lug of lifter arm **425** on the retraction lever **142**, lifting retraction lever **142**, and retracting the bolt **146** to unlatch the door.

The retraction lever **142** is engaged from beneath by extension **163** (see FIG. **1**B), which enters the escutcheon from thumbpiece **161** outside the door and gains access to the retraction lever **142** at the bottom of the casing halves **148**, **149**. Thus, depressing the thumbpiece **161** raises the extension **163** against the retraction lever **142** at the bottom of the casing halves **148**, **149**, thereby Bearing upward against the floor **426** of retraction lever **142**, pivoting the retraction lever **142** and moving the lateral pin **428** at its forward end upward along the ramped side of aperture **254** formed in the bolt **146**. This in turn cams the bolt **146** backward so that it retracts into the case **148**, allowing the door to open.

In summary of the functioning of the above-described components, FIG. **21** (A-D) is a composite sequential illustration of the operation of the central latch subassembly **140**.

At FIG. **21**(A), the central latch subassembly **140** is in a neutral position with pin **428** at the bottom of aperture **254** and bolt **146** therefore fully extended.

As seen at FIG. **21**(B), depressing the thumbpiece of FIG. **1**A raises the thumbpiece extension **163** which bears against the bottom of retraction lever **142** and pushes it upward. This pivots the retraction lever **142** and moves the lateral pin **428** at its forward end upward along the ramped aperture **254** formed in the bolt **146**. This in turn cams the bolt **146** backward so that it retracts into the case **148** allowing the door to open. Operation of the thumbpiece is entirely independent of the spindle hub **147**.

Latch retraction is also accomplished from inside the door by turning a knob or lever to turn the spindle hub **147**, which operates counterclockwise through the retraction lever **142** to retract the latch bolt **146**, and clockwise through the reversing lever **145** to do the same, both of these operation being described in more detail below. In either case the thumbpiece is not affected.

The foregoing is best seen in FIG. **21**(C), which illustrates the latch subassembly **140** with reversing lever **145** removed for illustration. When spindle hub **147** is turned counterclockwise, the inner cam surface **472** (see FIG. **20**) of spindle hub **147** bears against the lifter arm **425** of retraction lever **142**, thereby pivoting the retraction lever **142** and moving the lateral pin **428** at its forward end upward along the ramped aperture **254** formed in the bolt **146**. This in turn cams the bolt **146** backward so that it retracts into the case **148** allowing the door to open.

Conversely, as seen in FIG. **21**(D), when the spindle hub **147** is operated in the clockwise direction, the outer cam surface **471** (see FIG. **20**) engages the proximate end of reversing lever **145**, which then pivots. The extended lift arm on the other end of reversing lever **145** engages the lateral post **428** of the retraction lever **142**, lifting the retraction lever **142** and camming the bolt **146** backward. In both cases where the spindle hub **147** is operated the thumbpiece extension **163** (and hence thumbpiece **161**) is not affected.

One skilled in the art will now see that the foregoing configuration provides direct operation of the latch by the thumbpiece **161**. This entirely eliminates any need for off-axis rotary motion translation (by gears as in FIG. **21** or other mechanisms) as ordinarily used to adapt the axis of rotation of thumbpiece **161** to the orthogonal axis of rotation of spindle hub **147**. This reduces the total number of parts as well as the internal friction normally associated with the motion translator, thereby providing smoother operation and reduced wear cost.

Having now fully set forth the preferred embodiment and certain modifications of the concept underlying the present invention, various other embodiments as well as certain variations and modifications of the embodiments herein shown and described will obviously occur to those skilled in the art upon becoming familiar with said underlying concept. It is to be understood, therefore, that the invention may be practiced otherwise than as specifically set forth in the appended claims.

I claim:

1. A latch assembly, comprising: a tubular latch casing for mounting within a door; a bolt mounted in said latch casing for extension and retraction along a longitudinal axis to thereby latch said door along said longitudinal axis; a retraction lever mounted in said latch casing and coupled to the bolt and disposed for pivoting about a first pivot axis perpendicular to the longitudinal axis to retract the bolt; an operator for mounting to a face of the door and disposed for pivoting about a second pivot axis parallel to the longitudinal axis, the retraction lever pivoting about the first pivot axis in response to the operator pivoting about the second pivot axis; a spindle hub mounted in the latch casing, the spindle hub engaging the retraction lever to retract the bolt upon rotation of the spindle hub in a first direction; a reversing lever mounted in the latch casing, the spindle hub engaging the retraction lever to retract the bolt via the reversing lever upon rotation of the spindle hub in an opposite direction.

2. The latch assembly of claim **1**, wherein the spindle hub includes a first cam surface and a second cam surface, the first cam surface engaging the retraction lever to retract the bolt and the second cam surface engaging the retraction lever via the reversing lever to retract the bolt.

3. A latch assembly, comprising: a tubular latch casing for mounting within a door having a first axis, a second axis, and a third axis, the first axis being perpendicular to the second axis and the third axis; a bolt mounted in said latch casing for extension and retraction along the first axis to thereby latch said door along said longitudinal axis; a retraction lever mounted in said latch casing and coupled to the bolt and pivoting about the second axis for retracting the bolt; a reversing lever mounted in said latch casing and pivoting about the third axis and engaging the retraction lever to retract the bolt; and a spindle hub mounted within the latch casing and operated by an operator, said spindle hub having a first cam surface and a second cam surface, the retracting lever engaged by the first cam surface and pivoting about the second axis in response to rotation of the spindle hub in a first direction and the reversing lever engaged by the second cam surface and pivoting about the third axis in response to rotation of the spindle hub on a second direction.

4. The latch assembly of claim **3** wherein said operator is mounted to a face of the door and configured to pivot about a fourth axis parallel to the first axis, the retracting lever engaged by the operator and pivoting about the second axis in response to the pivoting of the operator about said fourth axis.

5. A latch assembly, comprising: a tubular latch casing for mounting within a door; a bolt mounted in said latch casing for extension and retraction along a first axis to thereby latch said door along said longitudinal axis; a retraction lever mounted in said latch casing; a reversing lever mounted in said latch casing for retracting the bolt by engaging the retraction lever; a spindle hub rotatably mounted in said latch casing and including a first cam surface for engaging the retraction lever and a second cam surface for engaging the reversing lever; a first operator for mounting to a face of the door and disposed for pivoting about a second axis perpendicular to the first axis, said first operator coupled to, and coaxial with the spindle hub, the retraction lever engaged by the first operator via the spindle hub and retracting the bolt in response to the first operator pivoting about the second axis; and a second operator for mounting to another face of the door

and disposed for pivoting about a third axis parallel to the first axis, the retraction lever engaged by the second operator and retracting the bolt in response to the second operator pivoting about the third axis.

6. The latch assembly of claim **5** wherein the first cam surface engages the retraction lever in response to rotation of the first operator in a first direction and the second cam surface engages the reversing lever in response to rotation of the first operator in a second direction, thereby retracting the bolt.

7. The latch assembly of claim **5** wherein the retraction lever is pivotable about a first pivot axis perpendicular to the first axis.

8. The latch assembly of claim **5** wherein the reversing lever is pivotable about a second pivot axis perpendicular to the first axis.

9. The latch assembly of claim **5** wherein the bolt further comprises a tail portion having an elongated slot formed at an angle to the first axis and the retraction lever further comprises a pin disposed in the slot such that rotation of the retraction lever laterally translates the pin in the slot causing the bolt to retract.

10. The latch assembly of claim **5** wherein the retraction lever is mounted at a first end of said casing extending toward and engaging a distal end of the bolt mounted at an opposite end of the casing, the spindle hub is mounted between the retraction lever mounting point and the distal end of the bolt and the reversing lever is mounted between the spindle hub and the bolt.

11. A method of retracting a latch disposed in a latch casing comprising the steps of: providing a tubular latch casing for mounting within a door; providing a bolt mounted in said latch casing for extension and retraction along a longitudinal axis to thereby latch said door along said longitudinal axis; providing a retraction lever pivotally mounted in the latch casing for pivoting about a first axis perpendicular to the longitudinal axis to retract the bolt; providing a reversing lever pivotally mounted in the latch casing, providing a spindle hub within the latch casing including a first cam surface for engaging the retraction lever to retract the bolt and a second cam surface for engaging the retraction lever via the reversing lever to retract the bolt; providing a first operator mounted to a face of the door and coupled to the spindle hub, the spindle hub engaging the retraction lever in response to rotation of the first operator in a first direction and the spindle hub engaging the retraction lever via the reversing lever in response to rotation of the first operator in a second direction.

12. The method of claim **11** further including the step of providing a second operator for mounting to a face of the door and pivotable about a second pivot axis parallel to the longitudinal axis of the bolt, the retraction lever retracting the bolt in response to pivotal movement of the second operator.

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